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Morphological And Biochemical Blood Parameters In Healthy And Mastitic Cows

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Abstract: In this article, the biochemical parameters of blood in healthy cows and cows affected by mastitis were studied experimentally. The results showed that with the development of pathological processes in the udder, the levels of total protein and glucose decreased compared to healthy cows, while the levels of bilirubin, urea, creatinine, and cholesterol were higher than in healthy animals.

It was also determined that during the development of subclinical mastitis in lactating cows, the level of amylase decreased by 4% and alkaline phosphatase decreased by 9.5%.

Based on the obtained results, it was concluded that the development of inflammatory processes in the udder and the use of effective therapeutic drugs significantly affect the morphological and biochemical parameters of cows' blood.

Keywords: Cow, mastitis, infection, mammary glands, blood, morphology, subclinical mastitis, hemoglobin, erythrocyte, preparation, leukocyte, thrombocyte, biochemistry.

Introduction: In livestock farms, the incidence of mastitis in dairy cows accounts for 20–25% when milking is performed manually, 35–40% when using milking machines, 17.5% during the drying-off period, and 20–23.7% during the dry period. This disease causes significant economic losses in animal husbandry. The productive lifespan of high-yielding animals in farms is reduced to 6–8 years [1,3].

The diagnosis, treatment, and prevention of infectious mastitis in cattle, determination of the disease prevalence, early diagnosis, and implementation of modern treatment and systematic control measures—taking into account zoohygienic requirements in animal management—are among the urgent tasks in veterinary practice [2].

Currently, the incidence of mastitis in dairy cows in livestock farms is 20–25% with manual milking, 35–40% with machine milking, 17.5% during the drying-off period, and 20–23.7% during the dry period. This disease causes substantial economic damage to livestock production. In particular, the total milk yield decreases by 15–20%, and milk fat content declines by 0.8–1% [6,7].

Unfavorable environmental factors in many regions of the world negatively affect the resistance of livestock organisms and create favorable conditions for the spread of mastitis pathogens [4,5].

Purpose and objectives of the study. Evaluating the morphological and biochemical parameters of dairy cows' blood to assess the state of metabolic processes and overall resistance of the organism, as well as studying the duration of treatment and the mechanism of action of medicinal products, is an important task.

METHODS

The hematological parameters of cows were studied according to the following scheme: first, morphological and biochemical blood parameters were examined in clinically healthy cows and in cows with subclinical mastitis. Then, in cows with subclinical mastitis, blood tests were performed before treatment and 48 hours after treatment.

In dairy cows, inflammatory processes in the udder (mastitis) lead to significant changes in hematological parameters. The experiment was conducted on three groups of cows during the lactation period: the first group consisted of clinically healthy cows, while in the second and third groups, subclinical mastitis was diagnosed during lactation. In the second group, the local preparation "Immunoil" was used to treat mastitis. The drug was administered three times at 24-hour intervals after evening milking. In the third group, cows were treated with the antimastitis preparation "Lerot-2." The preparations were used in accordance with generally accepted methods for the treatment of mastitis in cows.

RESULTS

In clinically healthy cows, the erythrocyte count was (6.25 ± 0.07) $\times 10^{12}$/L, which was found to be 3% higher compared to diseased animals (Table 1). After the administration of therapeutic preparations, the erythrocyte count increased by 4.2% in the second group of cows and by 4.4% in the third group.

In healthy cows, the hemoglobin concentration was 112.33 ± 4.51 g/L. In cows suffering from subclinical mastitis, this indicator was 8.6% lower. The hematocrit level in healthy animals was 31.88%, while during the inflammatory process it increased on average by 3.2%. After the use of therapeutic antimastitis preparations, hematocrit values decreased and returned to physiological norms.

In healthy animals, the leukocyte count was (7.34 ± 0.08) $\times 10^{9}$/L, whereas in cows with subclinical mastitis it was 10.4% higher (P<0.01).

Analysis of the leukocytogram in healthy cows and cows with subclinical mastitis before and after treatment showed consistent changes in its parameters. Thus, with the development of subclinical mastitis, the number of neutrophils increased by 1.55%, eosinophils by 0.93% (P<0.01), and monocytes by 0.7% (P<0.05), while the lymphocyte level decreased by 5.15% in dairy cows as the pathology progressed.

With the development of inflammatory processes in the mammary gland of dairy cows, erythrocytes were (6.07 ± 0.11) $\times 10^{12}$/L, hemoglobin level was 102.67 ± 3.51 g/L, and lymphocytes accounted for 56.34 ± 1.47%. At the same time, increases were observed in leukocytes (8.19 ± 0.10) $\times 10^{9}$/L, neutrophils (33.31 ± 0.65%), eosinophils (6.25 ± 0.16%), and monocytes (4.50 ± 0.11%).

After the use of effective therapeutic antimastitis preparations, gradual recovery of dairy cows was observed within 48 hours. This was confirmed by blood parameters approaching those of healthy cows: erythrocytes (6.33 ± 0.04) $\times 10^{12}$/L, hemoglobin 113.67 ± 3.06 g/L, lymphocytes 60.83 ± 1.34%, leukocytes (7.41 ± 0.19) $\times 10^{9}$/L, neutrophils 31.79 ± 0.32%, eosinophils 5.35 ± 0.15%, and monocytes 4.03 ± 0.08%.

Table 1.

Morphological blood parameters of healthy and mastitic cows

Parameters	Healthy animals (n = 3)	Diseased animals before treatment (n = 3)
Erythrocytes, $\times 10^{12}$/L	6,25±0,07	6,07±0,11
Hemoglobin, g/L	112,33±4,51	102,67±3,51
Hematocrit, %	31,88±1,19	35,39±0,57
Leukocytes, $\times 10^{9}$/L	7,34±0,08	8,19±0,10**
Neutrophils, %	31,76±0,29	33,31±0,65
Eosinophils, %	5,32±0,08	6,25±0,16**
Monocytes, %	3,80±0,14	4,50±0,11*
Lymphocytes, %	61,49±2,38	56,34±1,47

* – P < 0.05;

** – P < 0.01 – significance compared with the indicators of healthy animals.

Table 2

Morphological blood parameters of cows treated with Immunoil and Lerot-2 preparations

Parameters	Cows with mastitis before treatment (n = 3)	Cows 48 hours after mastitis treatment	
		Khimeks, Immunoil preparation (n = 3)	Immunoil, Lerot-2 preparation (n = 3)
Erythrocytes, $\times 10^{12}$/L	6,07±0,11	6,33±0,04	6,34±0,05
Hemoglobin, g/L	102,67±3,51	113,67±3,06	112,00±2,65
Hematocrit, %	35,39±0,57	32,13±0,31**	32,33±0,49*
Leukocytes, $\times 10^{9}$/L	8,19±0,10	7,41±0,19*	7,47±0,16*
Neutrophils, %	33,31±0,65	31,79±0,32	31,47±0,38
Eosinophils, %	6,25±0,16	5,35±0,15*	5,37±0,26*
Monocytes, %	4,50±0,11	4,03±0,08*	4,08±0,15
Lymphocytes, %	56,34±1,47	60,83±1,34	62,13±1,47*

* – P < 0.05;

** – P < 0.01 – significance compared with the indicators of animals before treatment.

Changes were also observed in the biochemical blood parameters of the experimental cows. With the development of pathological processes in the udder, the total protein level decreased by 9.1% and glucose by 17.7% compared to healthy cows. At the same time, an increase in bilirubin by 14.5% and urea by 9.5% (P < 0.05) was observed (Tables 3, 4).

The creatinine level in the blood of healthy cows was 83.67 ± 2.28 mmol/L, while in mastitis it increased by 10.1%. In cows with inflammation, the cholesterol level was 32.5% higher (P < 0.01) than in healthy cows and reached 4.20 ± 0.10 mmol/L.

During the development of the subclinical form of mastitis in dairy cows, the amylase level increased by 4% (P < 0.05), while alkaline phosphatase decreased by 9.5%.

Analysis of the obtained results indicates that the development of inflammatory processes in the udder and the use of effective therapeutic drugs significantly affect changes in the morphological and biochemical blood parameters of cows.

Table 3

Biochemical blood parameters of healthy and mastitic cows

Parameters	**Healthy animals (n = 3)**	**Diseased animals before treatment (n = 3)**
Total protein, g/L	82,13±3,30	74,63±2,41
Bilirubin, mmol/L	7,15±0,07	8,19±0,15**
Glucose, mmol/L	1,75±0,05	1,44±0,11
Urea, mmol/L	3,17±0,06	3,47±0,07*
Creatinine, mmol/L	83,67±2,28	92,10±2,72

Cholesterol, mmol/L	3,17±0,12	4,20±0,10**
Alkaline phosphatase, U/L	126,67±3,06	114,70±4,04
Amylase, U/L	642,67±5,69	668,33±4,51*

* – P < 0.05;

** – P < 0.01 – significance compared with the indicators of healthy animals.

Table 4

Biochemical blood parameters of cows treated with Immunoil and Lerot-2 preparations

Parameters	Mastitic cows before treatment (n = 3)	Cows 48 hours after mastitis treatment	
		Khimeks, Immunoil preparation (n = 3)	Immunoil, Lerot-2 preparation (n = 3)
Total protein, g/L	74,63±2,41	81,23±2,30	82,40±4,10
Bilirubin, mmol/L	8,19±0,15	7,13±0,09**	7,25±0,13**
Glucose, mmol/L	1,44±0,11	1,74±0,08	1,73±0,10
Urea, mmol/L	3,47±0,07	3,28±0,08	3,25±0,06
Creatinine, mmol/L	92,10±2,72	85,97±0,78	85,80±1,65
Cholesterol, mmol/L	4,20±0,10	3,33±0,06**	3,27±0,21*
Alkaline phosphatase, U/L	114,70±4,04	127,43±2,52*	128,65±1,53*
Amylase, U/L	668,33±4,51	649,33±3,06*	644,67±5,13*

* – P < 0.05;

** – P < 0.01 – significance compared with the indicators of animals before treatment.

CONCLUSION

Based on the results obtained from the experiments, it can be emphasized that during inflammatory processes in the udder (mastitis) of dairy cows, significant changes occur in the morphological and biochemical blood parameters. The use of effective antimastitis preparations leads to the normalization of morphological and biochemical indicators in recovered animals, which reflects the recovery process and ultimately reduces the negative impact of inflammatory processes in the udder.

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